



Special Opportunities for Highly Sampled Areas

Robert G. Knox, for the HyspIRI concept study team

NASA's Goddard Space Flight Center,

Biospheric Sciences Branch, Code 614.4

Greenbelt, MD

HyspIRI Science Symposium on Ecosystem Data Products

May 4, 2010

Introduction

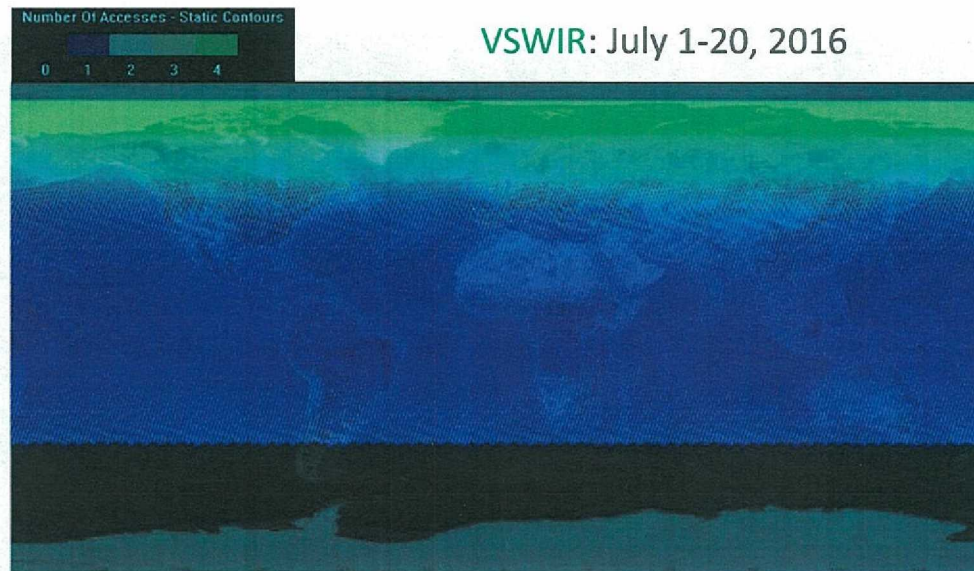
Context

- Some HypsIRI process questions can be addressed with samples, in lieu of full global maps.
- Some VSWIR questions will be difficult to answer without some information at intervals < 19 days.
- Some areas may have repeat TIR data over short intervals (e.g., day-night pairs).

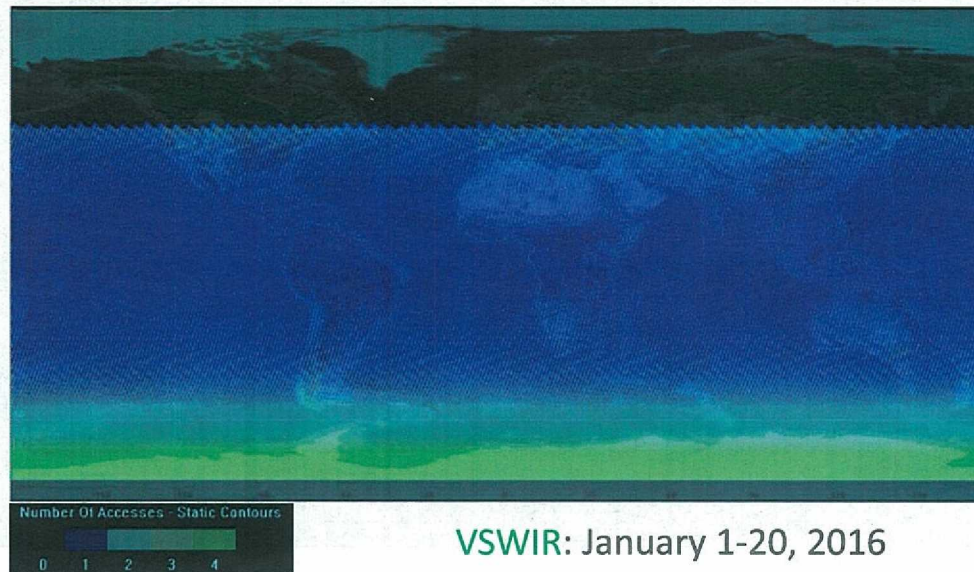
Outline

- VSWIR Coverage simulations
 - Global coverage grids
 - Example FLUXNET tower sites
- TIR coverage simulations
 - Global coverage grids
 - Example FLUXNET tower sites
- Minimum TIR revisit intervals and opportunities to measure diurnal variation.

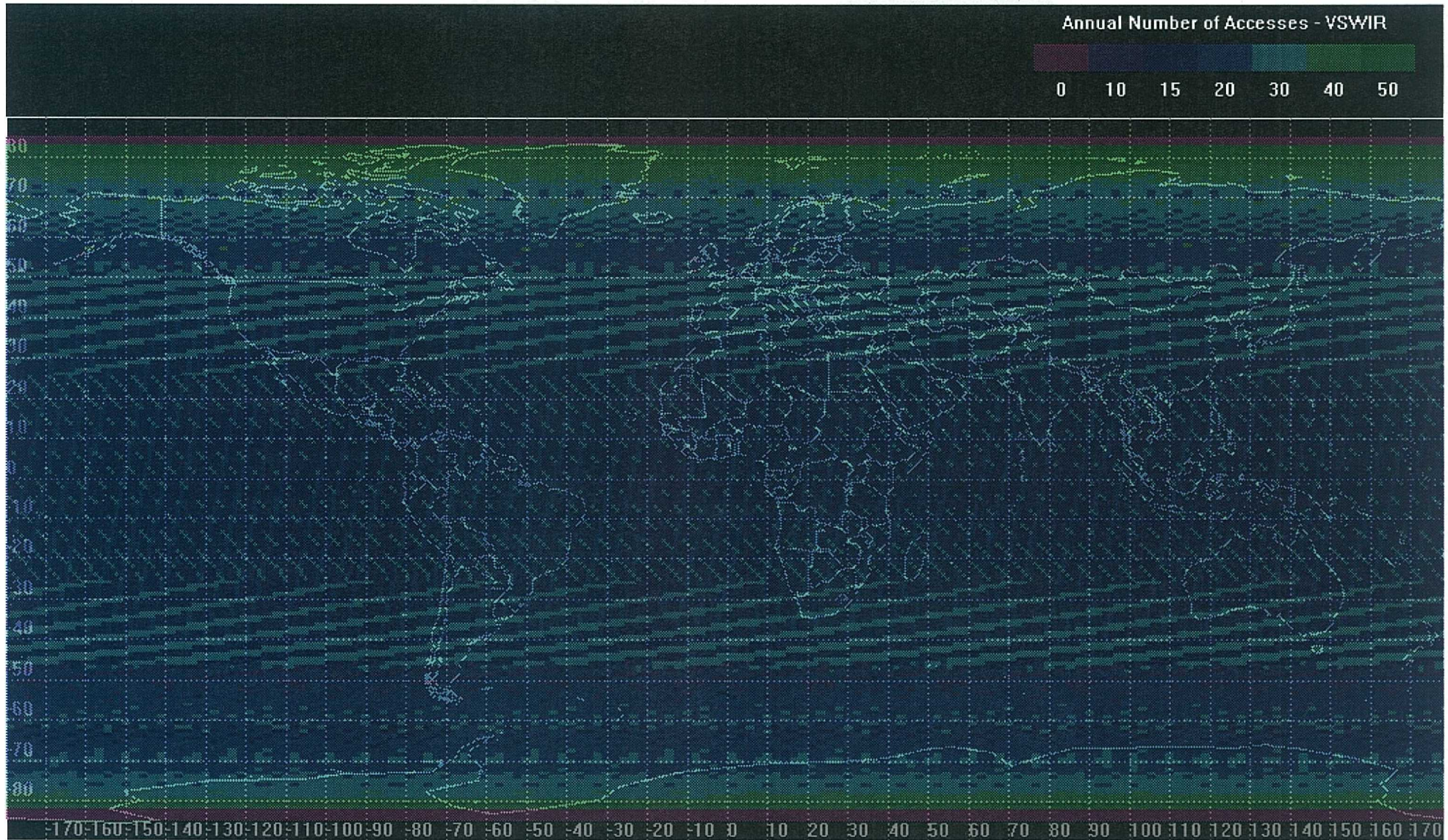
VSWIR coverage frequency varies seasonally



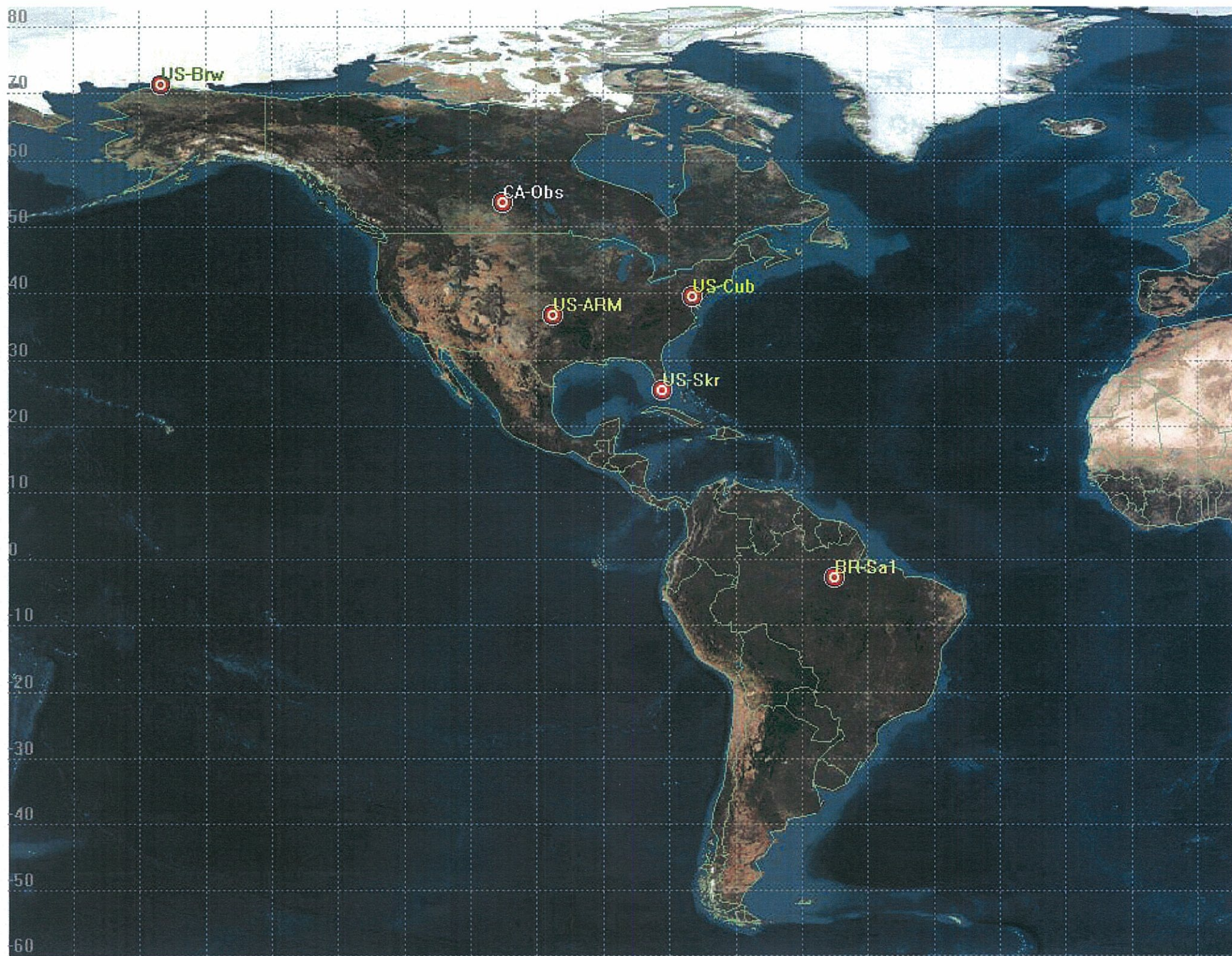
VSWIR coverage is limited by constraint: minimum 20 deg. Sun elevation angle.



Annual VSWIR imaging opportunities in a 19-day repeating orbit,
1 yr. simulation, with a minimum solar elevation of 20°

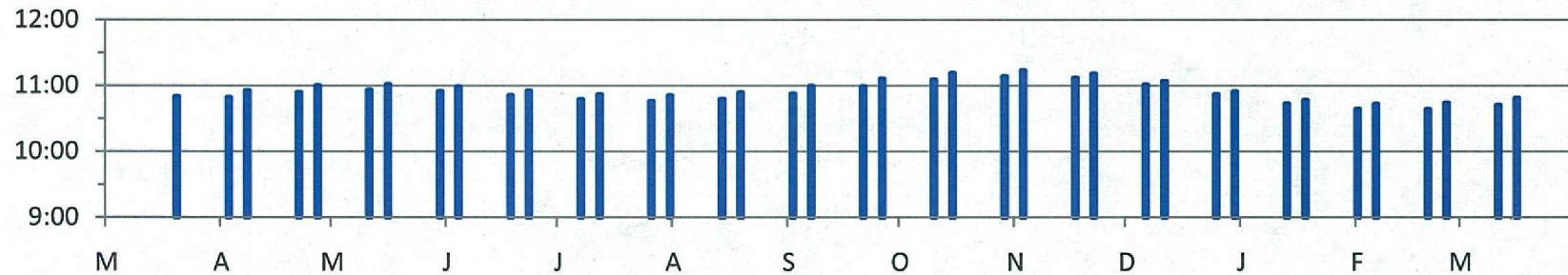


Nominal orbit: av. alt. 626.8 km, incl. 97.8°. VSWIR spectrometer FOV: 2.8° E, 10.8° W (60 m pixel GSD at nadir, 2480 cross-track pixels).
R.G. Knox, NASA GSFC, Biospheric Sciences Branch, Code 614.4. Simulated with STK v8.1.3, March 7, 2010. Note aliasing with sample grid.

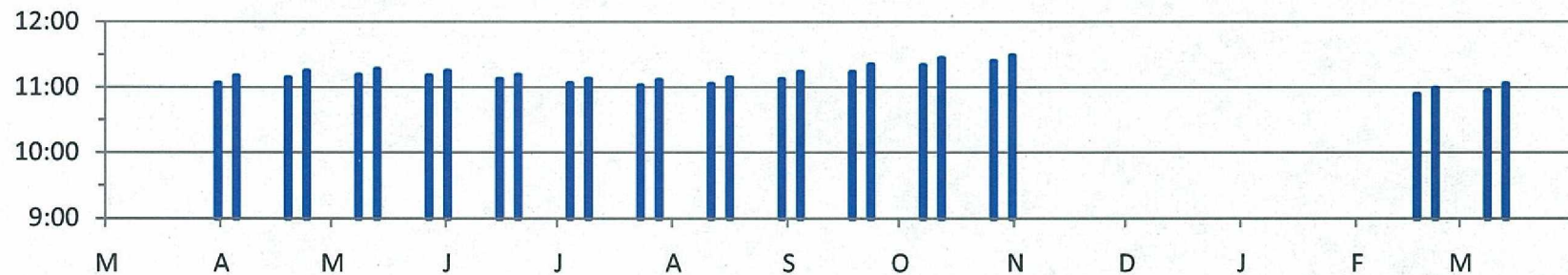


Examples of more frequent potential VSWIR accesses (swath overlap zones, high latitudes)

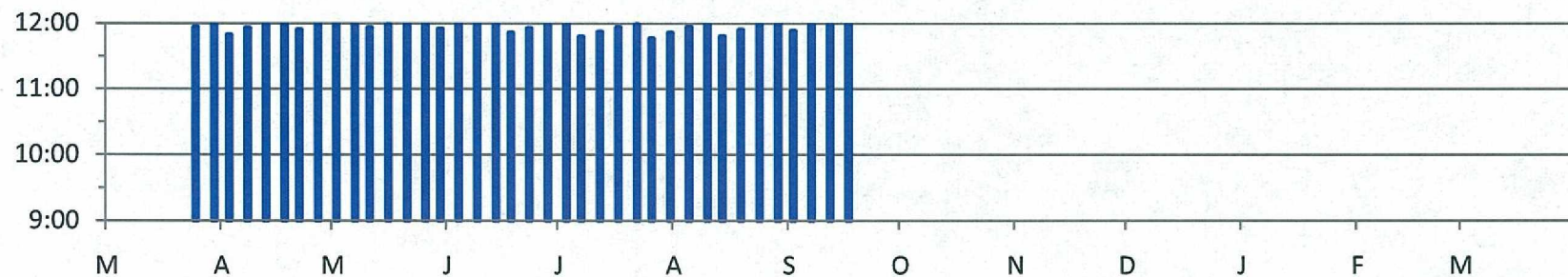
US-Cub, Baltimore LTER, Urban and Built-up, low density residential (39.41 N)



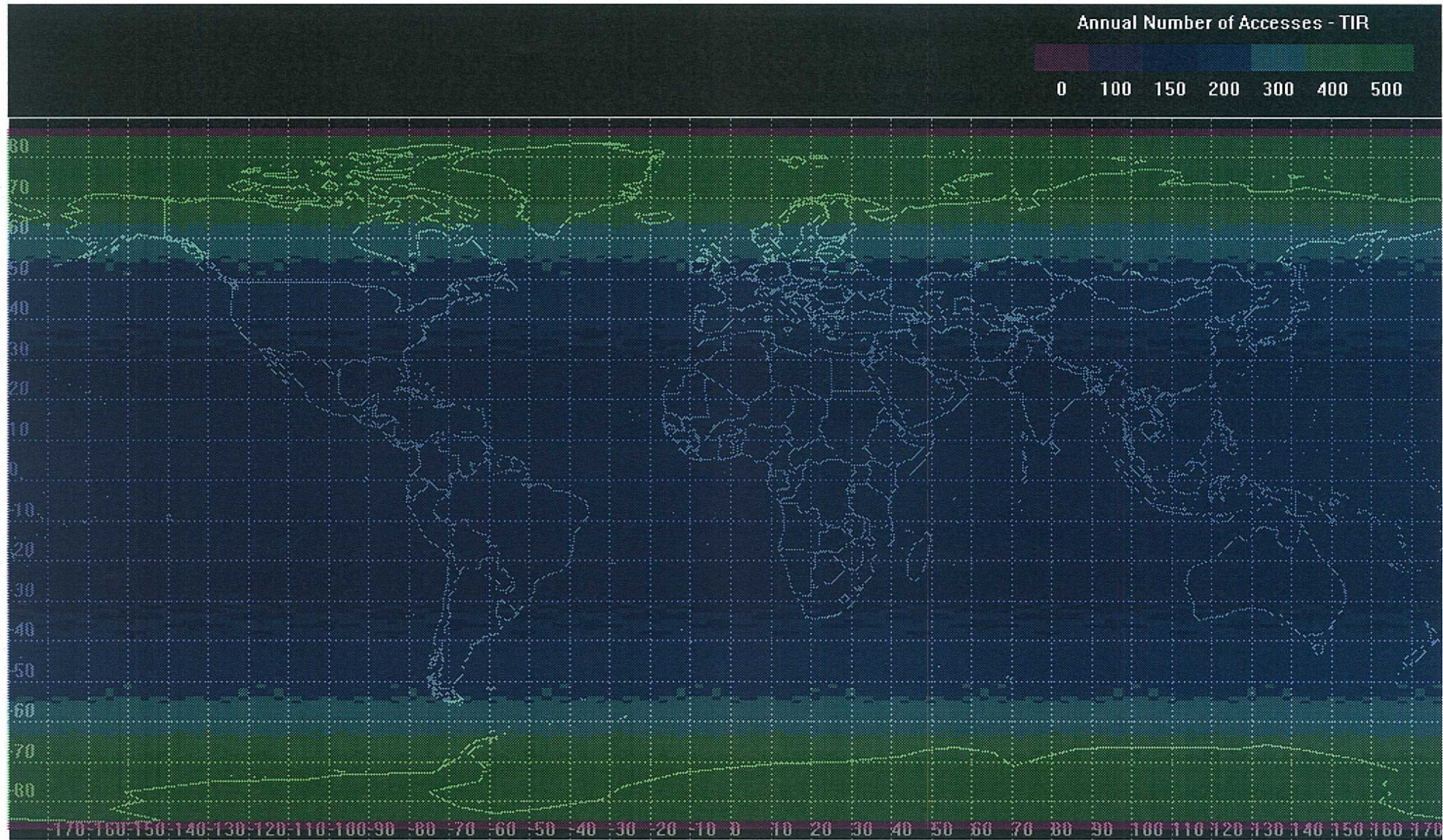
Canada - Saskatchewan - (BOREAS) SSA Old Black Spruce (53.99 N)



US - Barrow, Alaska, Moist Tundra (71.32 N)

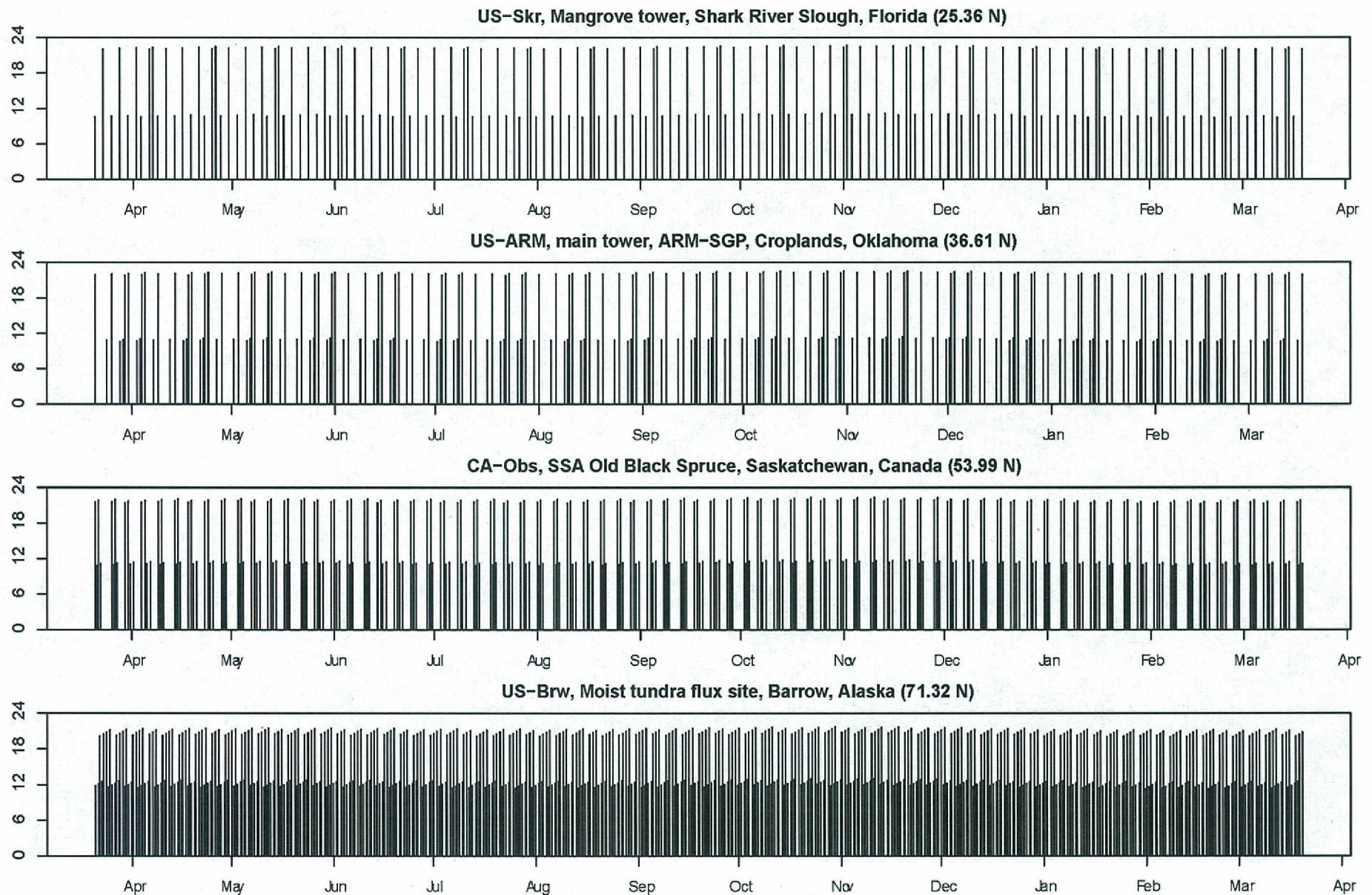


Annual TIR imaging opportunities in a 5-day near-repeating orbit, 1 yr. simulation



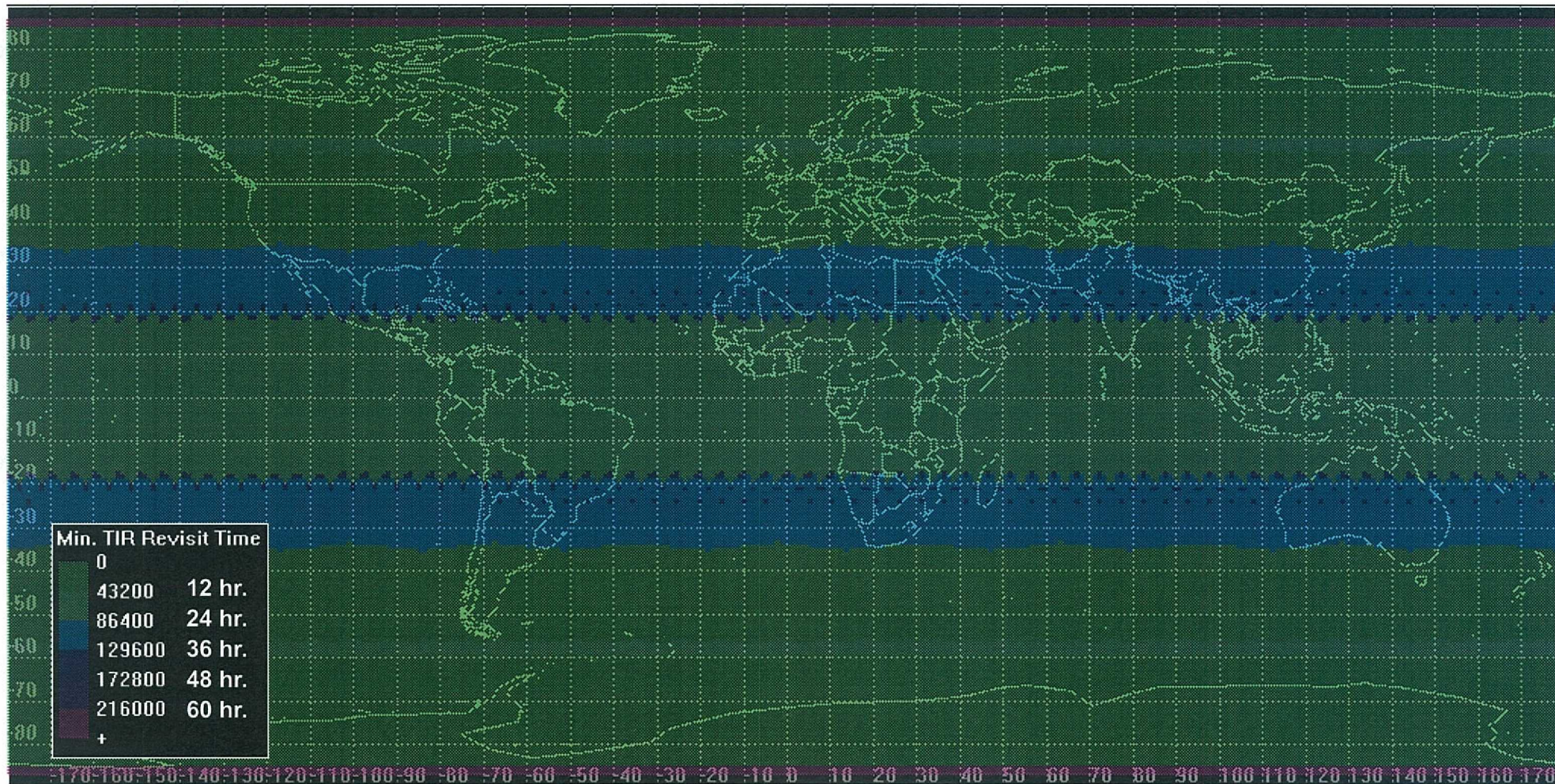
Nominal orbit: average alt. 626.8 km, inclination 97.8°. TIR imager FOV: $\pm 25.46^\circ$ (60 m pixel GSD at nadir, 9272 cross-track pixels).
R.G. Knox, NASA GSFC, Biospheric Sciences Branch, Code 614.4. Simulated with STK v8.1.3, March 7, 2010. Plotted May 3, 2010.

Frequent TIR coverage occurs at mid-latitudes and higher



Minimum times between Multispectral Thermal (TIR) Imager accesses

Potential accesses simulated for 1 year, sampled over a 1 by 1 deg. grid



Nominal orbit: alt. 626.8 km, incl.: 97.8. TIR sensor FOV: +/- 25.46 (60 m pixel GSD at nadir, 9272 cross-track pixels).

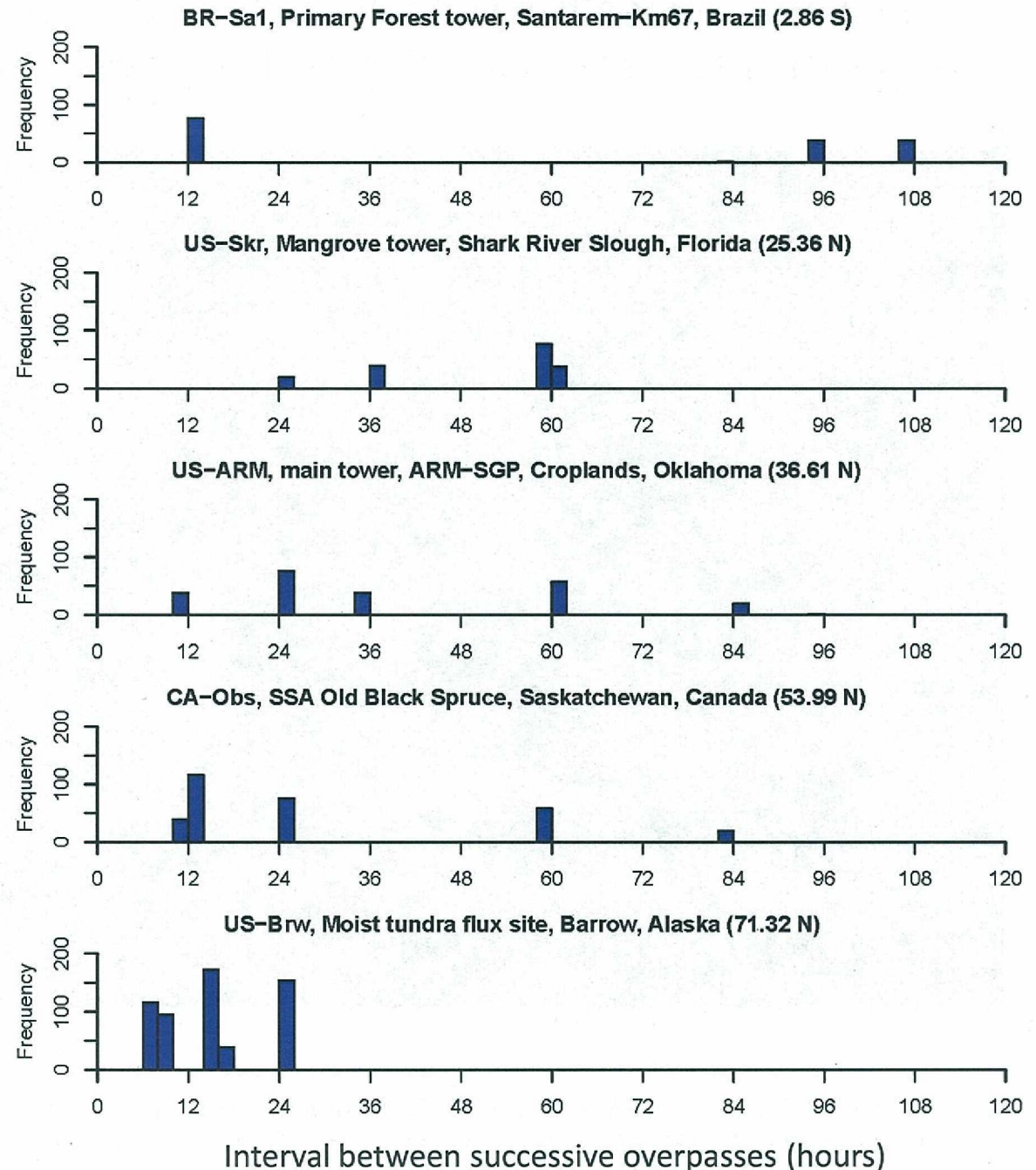
R.G. Knox, NASA GSFC, Biospheric Sciences Branch, Code 614.4. Simulated with STK v8.1.3, March 20, 2010. Plotted May 3, 2010.

Frequency Distributions of Intervals between Potential Coverage with the TIR Instrument

Equatorial sites have frequent day-night pairs, separated by 4 days or 4.5 days.

High latitudes are characterized by revisit intervals that are daily or shorter.

A subset of subtropical locations have most overpasses separated by 2.5 days (the worst case in a 5-day repeat with both daytime and night data).



Some conclusions & questions: Highly sampled areas

- A feasible design to meet 5-day and < 20 day requirements (the reference orbit and instrument concepts) also provides highly sampled areas: e.g., high latitudes, overlapping swaths.
- The reference orbit and TIR instrument swath provides day-night pairs—within 24 hours at many locations (was not a mission requirement).
- Questions:
 - *What science questions could best be addressed in highly sampled areas? With what level 3 or 4 data products?*
 - *Will VSWIR swath overlap zones vary over course of the mission? (orbit nodes drift away from fixed longitudes) How would that change data products?*
 - *Does the complicated pattern of time intervals between TIR re-visits, notable in some regions, present difficulties for deriving a consistent sets of products using, for example, diurnal temperature differences?*

